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US 4377291 A

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(54) An expansion seal for cable pipe

(57) An expansion seal for sealing a pipe through which electrical cables are arranged to pass comprises an elastic ring 2, a plurality of upper clamping plates 1 and a plurality of lower clamping plates 3 each preferably of plastics or rubber material. The elastic ring is supported between a plurality of the upper and lower clamping plates, at the circumference of this elastic ring having a slit to allow insertion of cable therein and to cover the cable easily. The elastic ring and cable is locatable in a cable pipe and fixed at one end of the cable pipe by screw bolts (41, Fig. 2). When the bolts are tightened (Fig. 7) the clamping plates 1, 3 force the elastic ring 2 to expand to fill the space between the inner wall of the elastic ring and cable and that between the elastic sealing ring and inner surface of the cable pipe, to prevent liquid, mud and moisture from entering into the cable pipe. Conveniently, the expansion seal can be applied to pipes of different inner diameters and cable of different outer diameters.

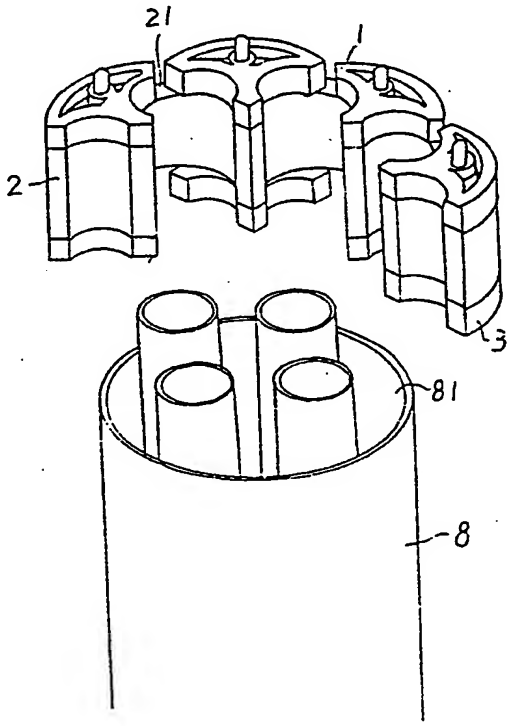

FIG.8

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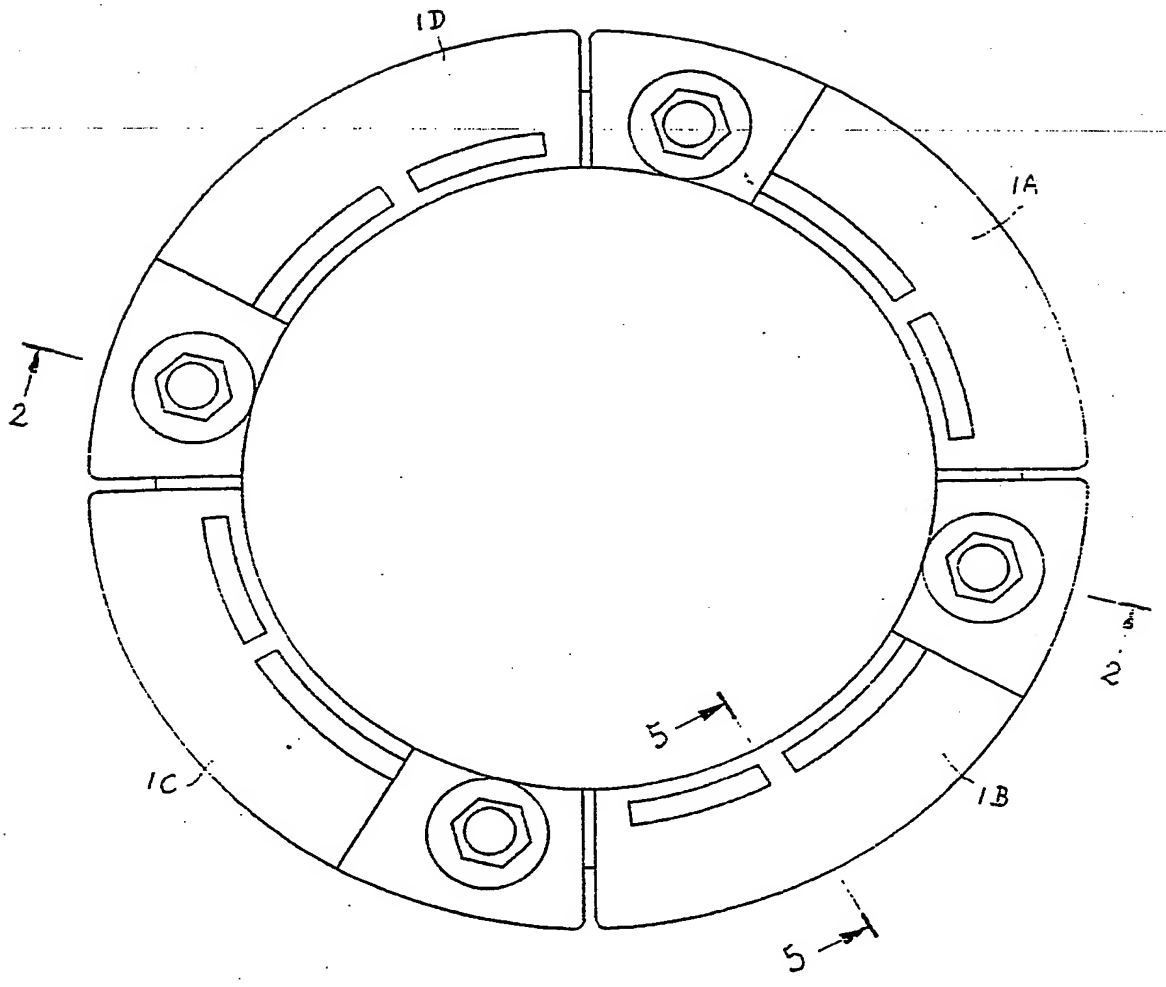
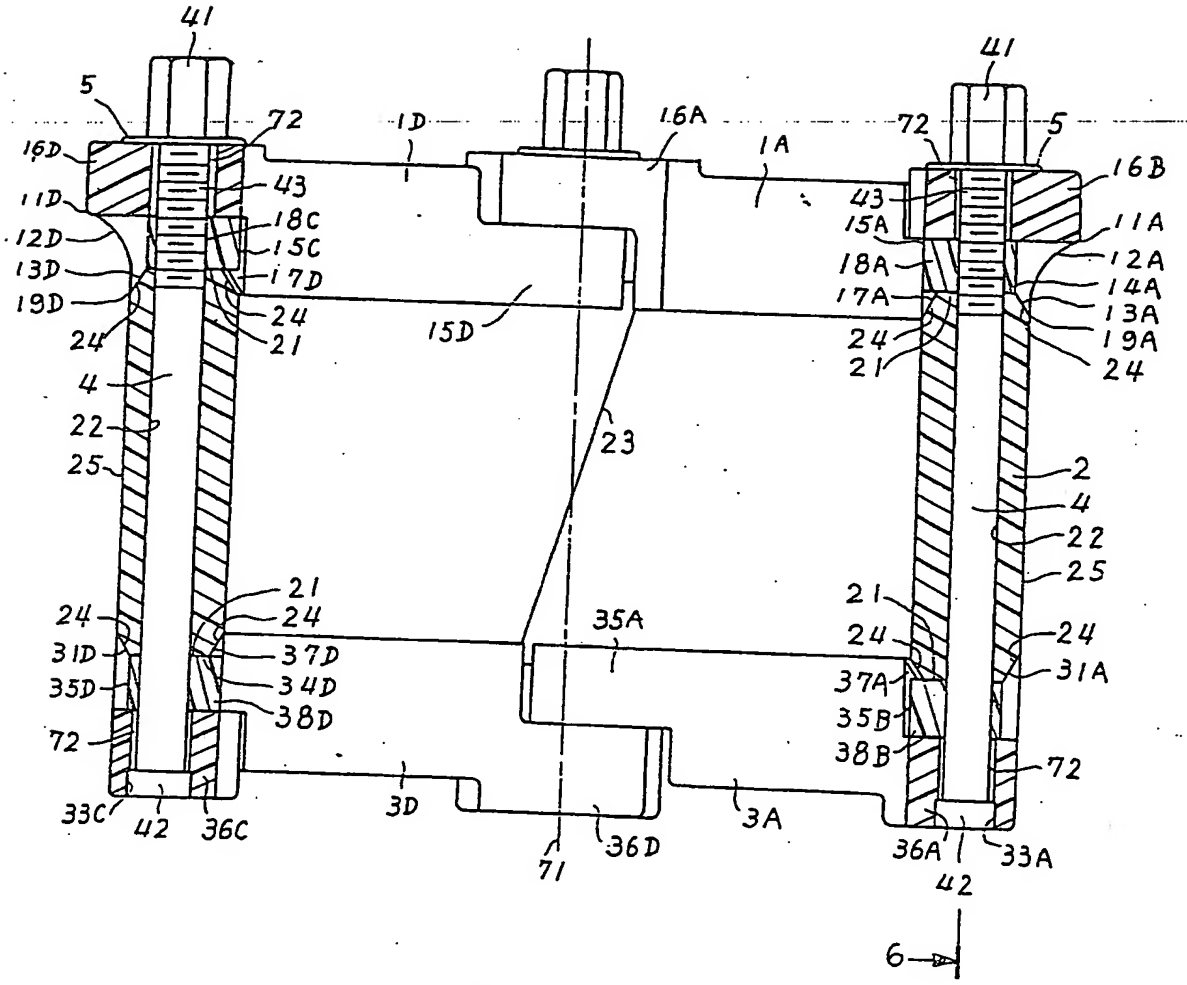


FIG.1


41
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72
16D
11D
12D
13D
19D
24
4
22
25
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18C
15C
17D
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15D
16A
1A
23
35A
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72
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16B
43
15A
18A
17A
24
21
11A
12A
14A
13A
19A
24
2
4
22
25
21
24
31D
35D
72
37D
34D
38D
21
24
24
37A
35B
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36C
3D
71
36D
3A
36A
33A
42
6

FIG. 2

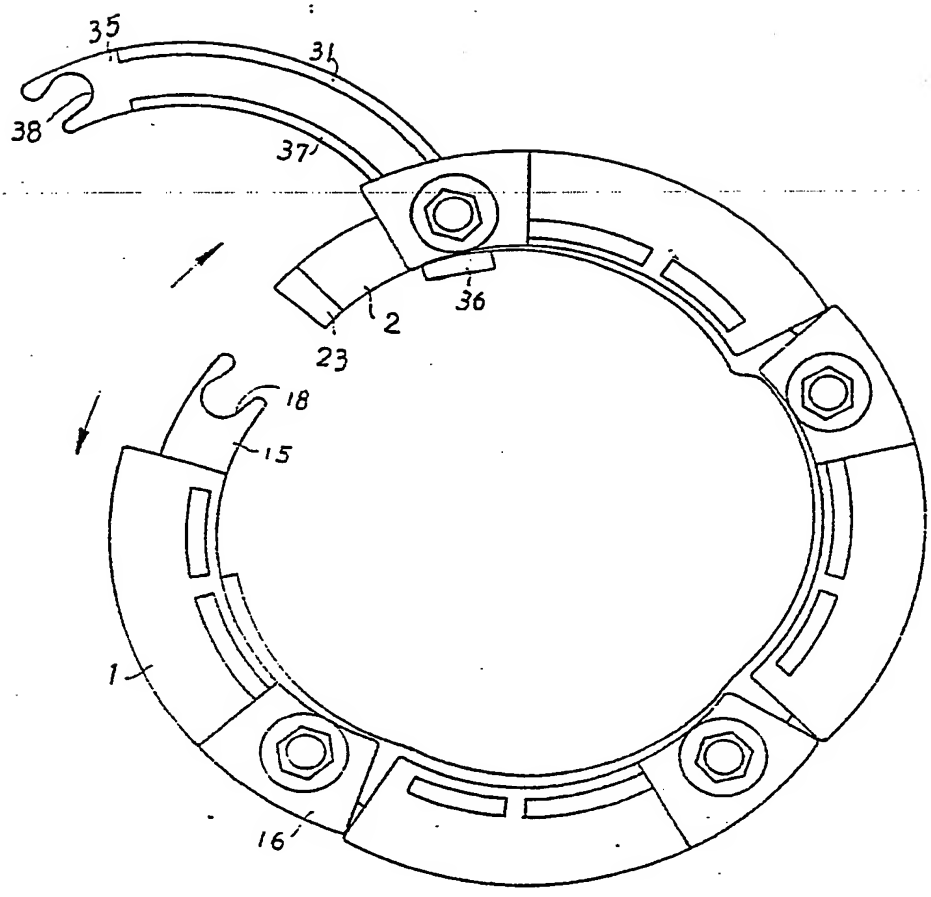


FIG.3

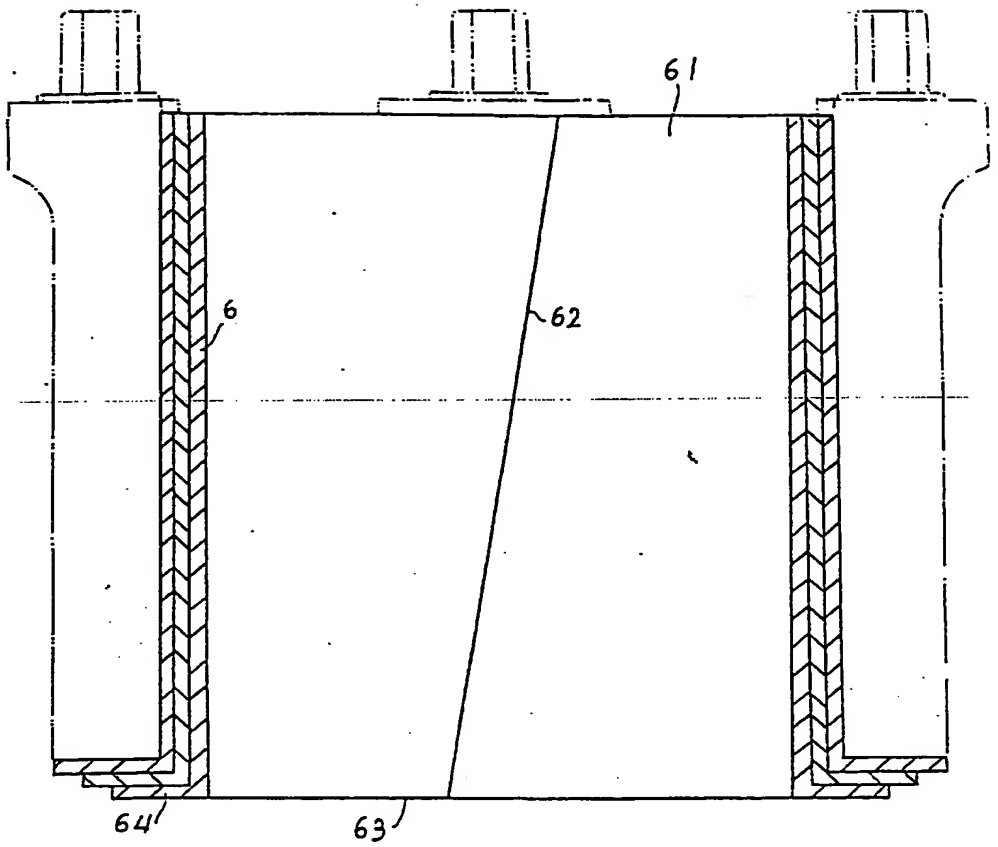


FIG.4

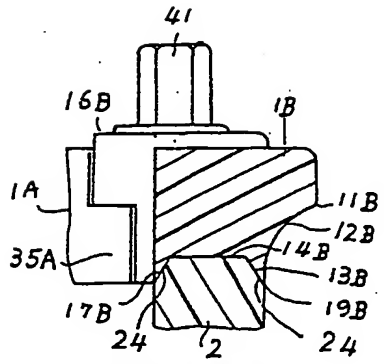


FIG.5

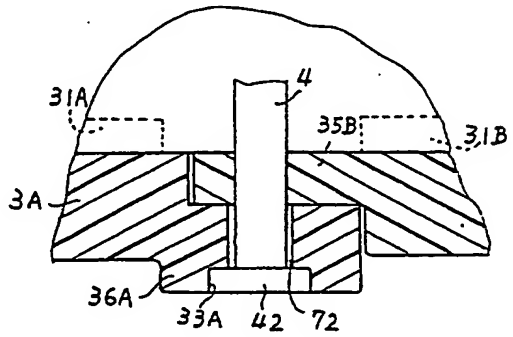


FIG.6

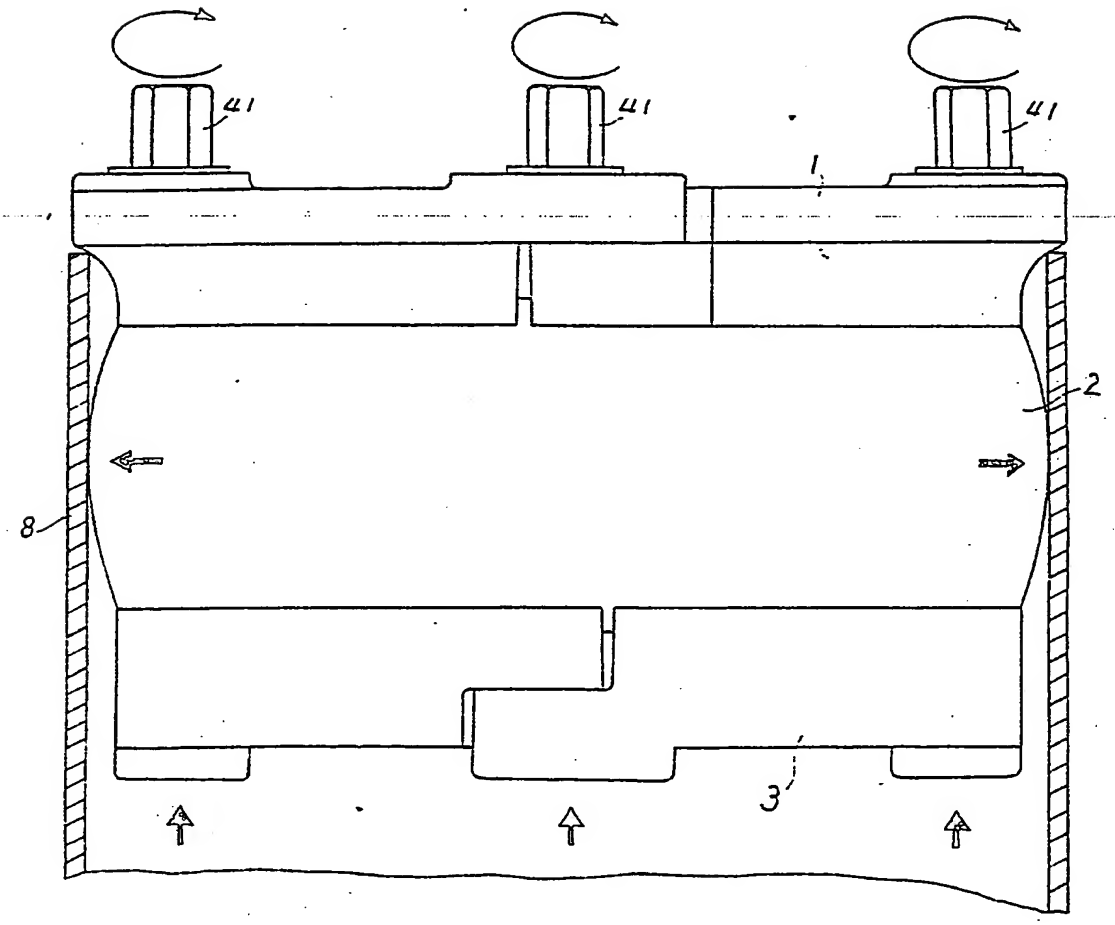


FIG.7

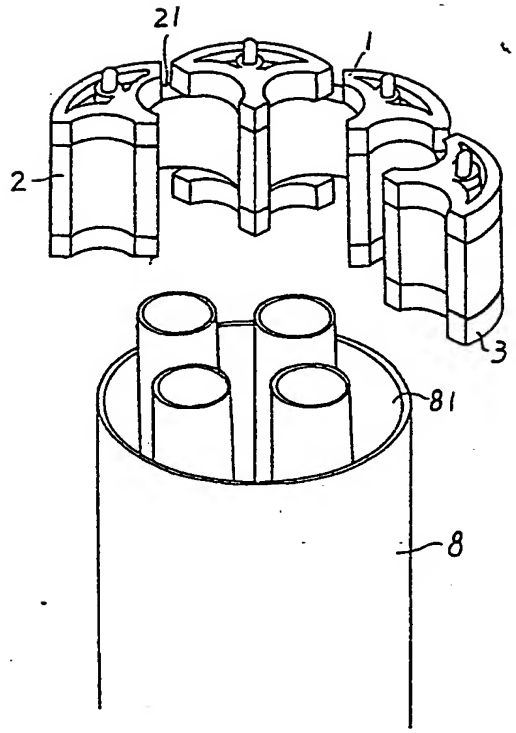


FIG.8

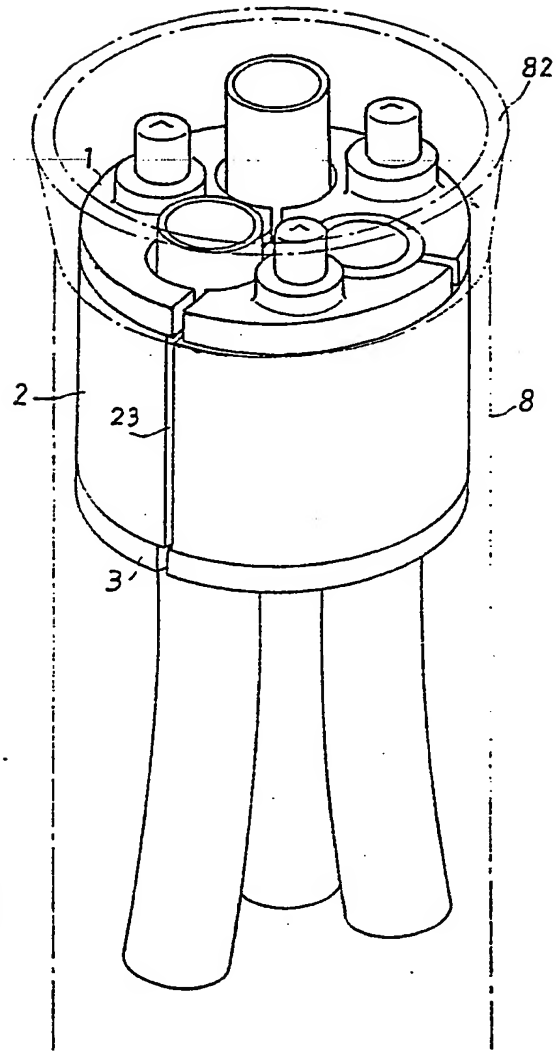


FIG.9

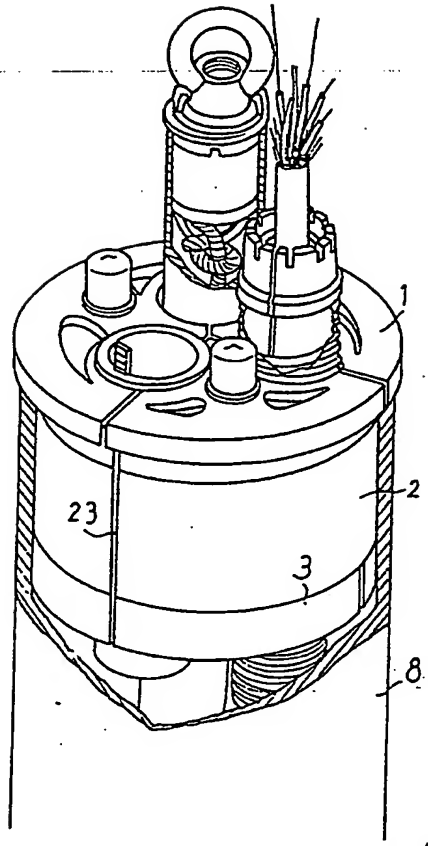


FIG.10

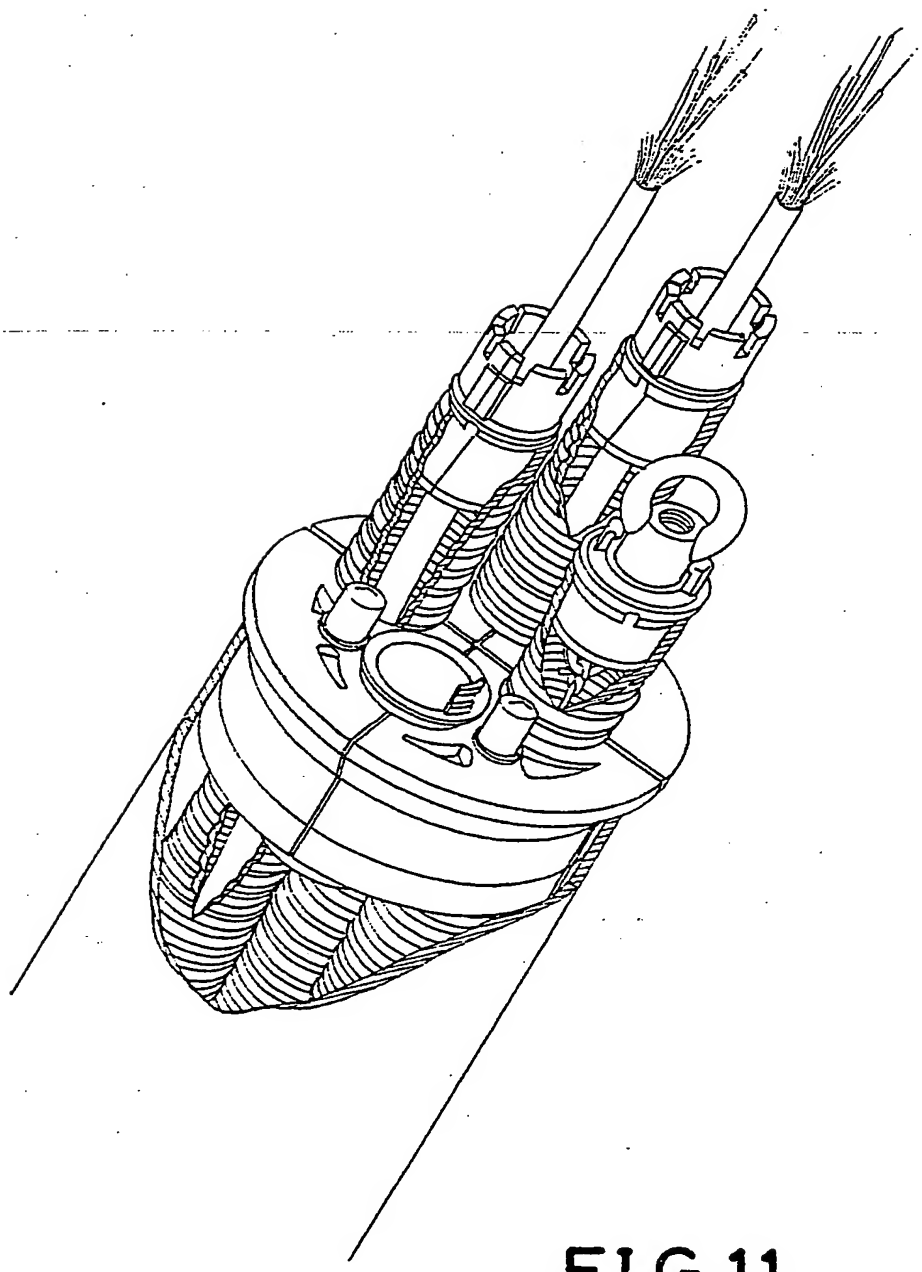
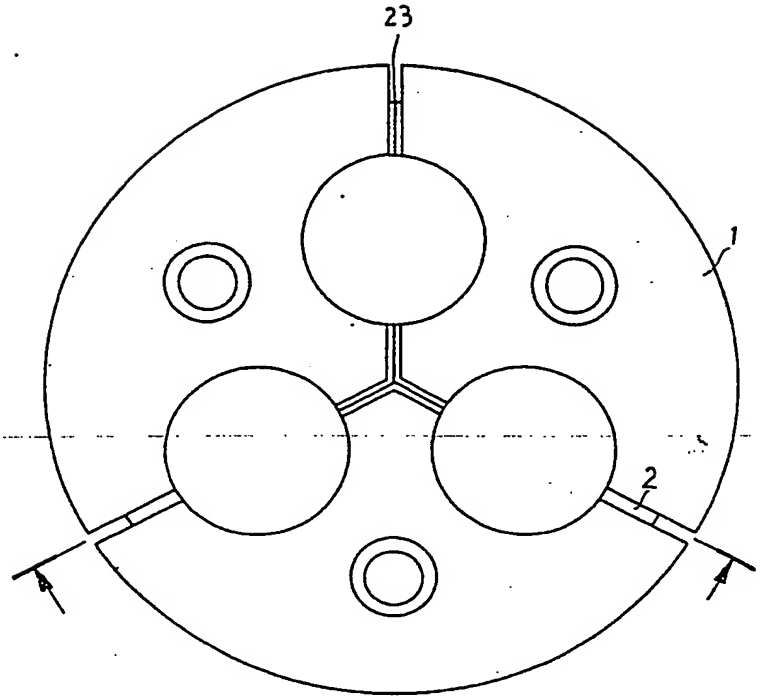


FIG.11



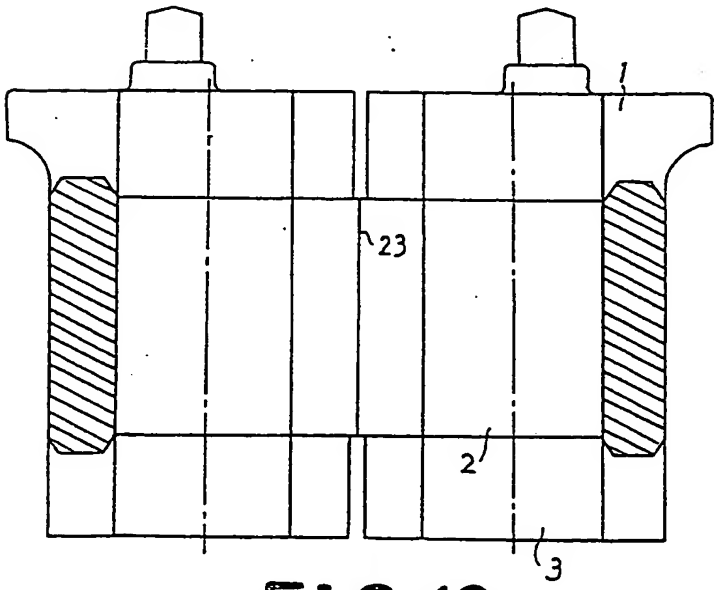
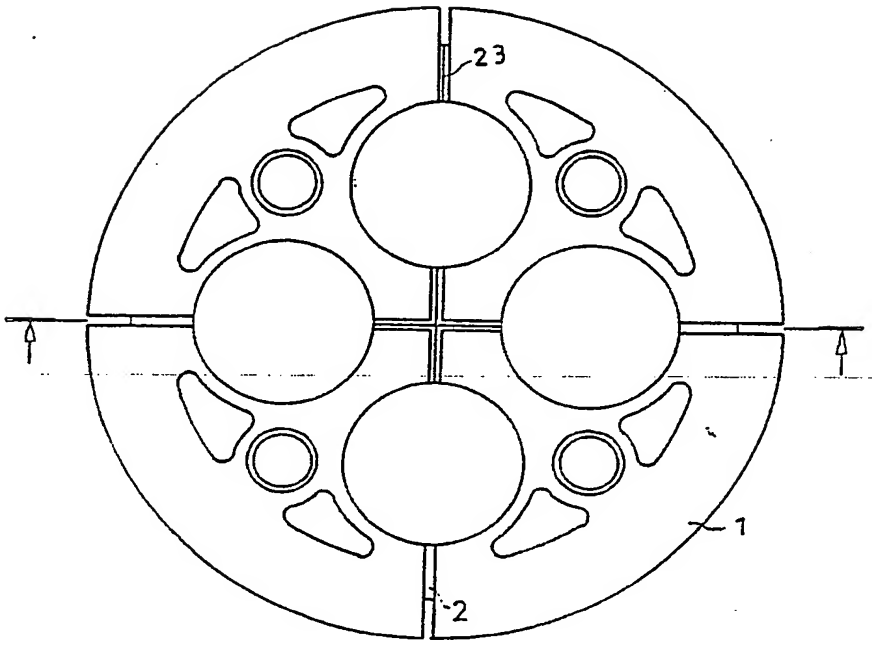


FIG.12



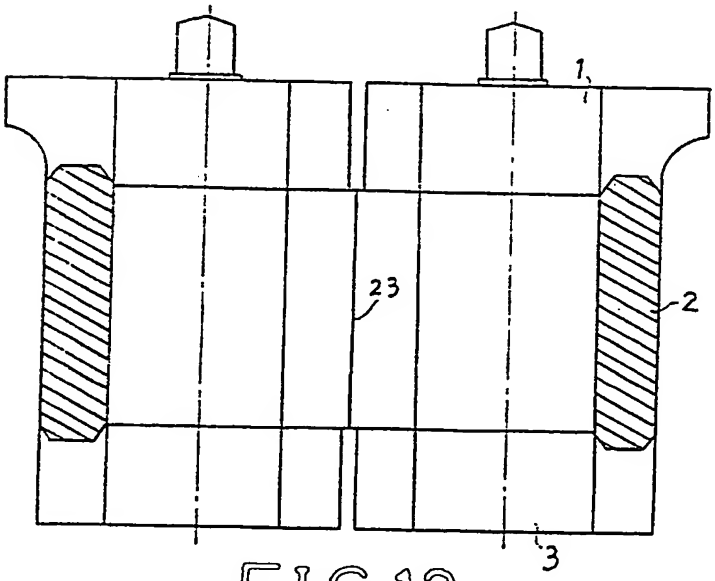


FIG.13

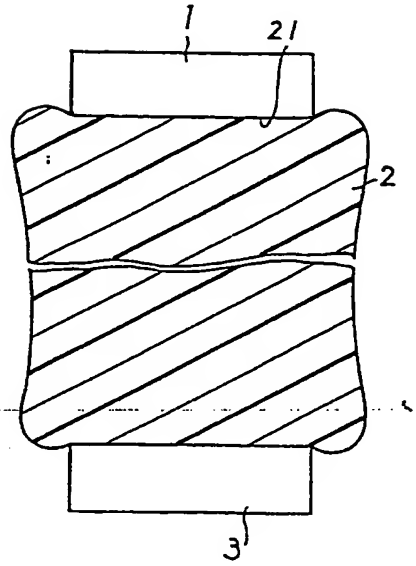


FIG.14

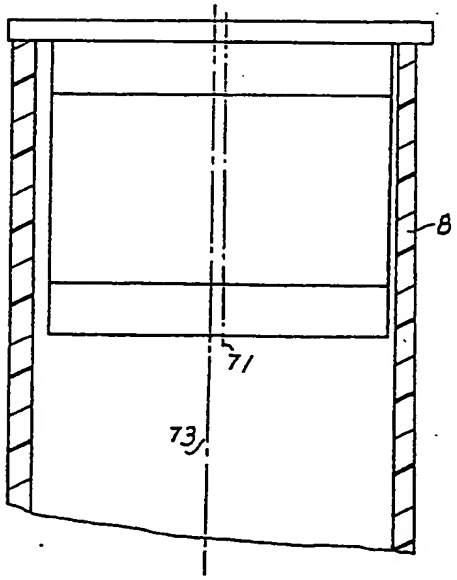


FIG.15

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AN EXPANSION SEAL FOR CABLE PIPE

This invention relates to an expansion seal for cable pipe.

An expansion seal can be applied to different diameter cable pipe by the expansion force of an elastic sealing ring hereinafter referred to as elastic ring to seal the pipe to prevent liquid or moisture entering into the cable pipe. The expansion seal can have a simplified structure and can be installed or separated quickly by fastening or loosening bolts without changing any elements.

In general, the same nominal external diameter electric cable pipes or transmission pipes may have a different inner diameter because of different manufacturing tolerance, the difference ratio always being below 10%. The end of the cable pipe should be sealed to prevent liquid, mud or moisture entering the cable pipe, otherwise, the cable may be damaged and an operator's life put in peril. Thus it is necessary to provide seals of various sizes to apply for different diameters of cable pipe. This raises manufacturing costs and causes operative inconvenience or disturbance.

It is therefore a object of this invention to provide an expansion seal for cable pipes which can overcome above disadvantages.

According to the present invention there is provided an expansion seal for cable pipe comprising a plurality of upper and lower clamping plates having frusto conical surfaces thereon, an elastic ring located between the upper and lower clamping plates and having a slit formed in the elastic ring at an angle relative the axis of

the ring, a plurality of symmetrical through holes located parallel to the said axis, slant faces on the upper surface and the lower surface of the elastic ring having advanced angles which form slant faces at the inner circumference and the outer circumference of the elastic ring; and a plurality of connecting elements arranged to interconnect the elastic ring, the upper clamping plates and the lower clamping plates.

In one embodiment of an expansion seal in accordance with the present invention the elastic ring of the expansion seal is fitted with different diameter pipe sleeves which can be cut respectively forming a slant lie and can be combined in various dimensions by adding or removing different diameter pipe sleeves so as to cover the different diameter cable easily.

In a further embodiment of this invention there is provided an expansion seal for a cable pipe, wherein the elastic ring can be manufactured with either a single fitting hole, two fitting holes, three fitting holes or four fitting holes, so that the expansion seal can be arranged to support cable pipe having a plurality of cables.

The expansion ring can be applied for various ratios (below 10%) of cable pipe to diameter of cable (within 20 mm). The plurality of upper clamping plates, the plurality of lower clamping plates and the elastic ring are connected together by bolts and nuts, so that upon fastening the bolts, the elastic ring is expanded outwardly.

Embodiments of an expansion seal for cable pipe in accordance with the present invention will now be

described by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a top view of an expansion seal of this invention having a single hole,

Fig. 2 is a sectional view on line 2-2 of Fig. 1,

Fig. 3 is a top view similar to Fig. 1 illustrating the seal in an opened condition,

Fig. 4 is an alternative embodiment of an expansion seal of this invention,

Fig. 5 is a sectional view of part of an upper clamping plate of the expansion seal on line 5-5 of Fig. 1,

Fig. 6 is a sectional view of part of a lower clamping plate of the expansion seal on line 5-5 of Fig. 1,

Fig. 7 is another embodiment of an expansion seal of this invention,

Fig. 8 is a further alternative embodiment of the expansion seal of this invention with four cable fitting holes,

Fig. 9 is yet another embodiment of the expansion seal of this invention with three fitting holes applied to cable pipe with a bellmouth shape at its end,

Fig. 10 is a further embodiment of the expansion seal of this invention with four fitting holes applied to a cable pipe with a plain end,

Fig. 11 is a perspective view of yet a further embodiment of the expansion seal of this invention with three fitting holes applied to a cable with a plain end,

Fig. 12A is an end view and Fig. 12B a sectional view on line 12-12 of Fig. 12A of an expansion seal of this invention with three cable fitting holes,

Fig. 13A is an end view and Fig. 13B a part sectional view on line 13-13 of Fig. 13A of an expansion seal of this invention with four fitting holes,

Fig. 14 is a part sectional view of an elastic ring for use in automatically adjusting the central axis of

the expansion seal within a cable,

Fig. 15 is a part sectional view of an expansion seal illustrating the automatic adjustment of the centre line thereof.

Referring to Fig. 2 there is shown an expansion seal for cable pipe having a plurality of upper clamping plates 1, a plurality of lower clamping plates 3, an elastic ring 2, a plurality of bolts 4, a plurality of gaskets 5 and a plurality of pipe sleeves 6. The elastic ring can be held between the upper clamping plates 1 and the lower clamping plates 3, the upper surface and lower surface 21 of the elastic ring 2 being curved.

According to the circumferential outline of the upper clamping plates 1 and the lower clamping plates 3, the surface 14 of the upper clamping plates 1 and the surface 34 of the lower clamping plates 3 will contact the upper surface and lower surface 21, respectively, of the elastic ring 2, so that the compressive force can distribute over the surface 21. The upper clamping plates 1 have a plurality of holes 72 and the lower clamping plates 3 have a plurality of recess holes 33 which are symmetrical to the holes 72 of the upper clamping plates 1 in an axial direction of the elastic ring 2 itself having a plurality of through holes 22 symmetrical to the holes 72 and the recess holes 33. Therefore, the upper clamping plates 1, the lower clamping plates 3 and the elastic ring 2 can be connected with each other by the bolts 4 with matching nuts 41 when a compressive force is added by tightening the bolts 4, the elastic ring 2 will be expanded outwardly until it contacts the inner wall 81 of the cable pipe thereby forming a seal to prevent liquid, mud or moisture entering into the cable pipe as shown in Fig. 7. The elastic ring 2 can be cut to form a slit 23 slanted so

that the elastic ring 2 can be formed into a rectangular shape.

As shown in Figs. 2 and 8, to cover the cable easily, the expansion seal is placed into the cable pipe, then the bolts 4 are fastened to fix the expansion seal on one end of the cable pipe.

Accordingly, the expansion seal for the cable pipe can be applied for a cable pipe which tapers outwardly at 82 at its end 8 as shown in Fig. 9.

Figs. 1 to Fig. 3 display the structure of the expansion seal having a single fitting hole, the upper clamping plate 1 comprising first and second steps 25, 16. The lower clamping plate 3 also comprises first and second steps 35, 36. The first steps 15, 35 have a surface 14, 34 which contacts the upper surface and lower surface 21 respectively of the elastic ring 2. The front of the first step 15, 35 has a clamp portion 18, 38 which can be fitted with the second step 36, 16 by the bolts 4. The gap between the first step 15, 35 and the second step 36, 16 is very little and therefore the compressive force can be transmitted to the elastic ring 2 equally, on the second step 16 of the upper clamping plate having a hole 72, and on the second step 36 of the lower clamping plate 3 having a recess hole 33 which is axially symmetrical to the hole 72. Thus the bold 4 can be fixed on a fitting flange 42 of the recess hole 33 and extend through the hole 22 of the elastic ring 2 and through the hole 72 so as to match with gasket 5 and nut 41. The upper clamping plates 1 and lower clamping plates are made of hard material such as brass, aluminum, hard plastics etc.

To achieve equal expansion of the elastic ring 2

and prevent the elastic ring from escaping out of the upper clamping plates and the lower clamping plates when an increased compressive force is applied to it, the outer circumferences of the upper clamping plates is formed into curve faces 12A - 12D from points 11A - 11D to points 19A - 19d and from the points 19A - 19D extending upward to contact the surfaces 14 - 14D forming slanted faces 13A - 13D at the inner circumferences of the upper clamping plates. These inner slant faces consist of slanted faces 17A - 17D of the first steps 15A - 15D which are symmetrical with the slant faces 13A - 13D at the outer circumferences and inner circumferences of the first steps 35A - 35D, 37A - 37D which is symmetrical to slant faces 13A - 13D, 17A - 17D as shown in Fig. 2. The edges of the upper surface and the lower surface 21 of the elastic ring 2 has slant faces 24 which can be matched with the slant faces 13A - 13D, 17A - 17D of the upper clamping plates 1 and the slant faces 31A - 31D, 37A - 37D of the lower clamping plates 3. Thus when fastening the bolts 4, the plastic ring 2 is be expanded outwardly equally in all directions and adjusted axially in accordance with the centre line of the cable pipe. The upper and lower surfaces of the elastic ring 2 are covered with the upper clamping plates 1 and the lower clamping plates 3 so that when fastening the bolts 4, the elastic ring 2 will be limited between the upper clamping plates 1 and lower clamping plates 3. If the surfaces 14A - 14D of the first steps 15A- 15D of the upper clamping plates 1A - 1D and the surfaces 34A - 34D of the first steps 35A - 35 of the lower clamping plates 3A - 3D are flat surfaces without any slant faces, the upper surface and the lower surface 21 of the elastic ring 2 is also a flat surface without any slant faces, as shown in Fig. 15, then when fastening the bolts 4, the centre line 73 of the cable pipe and the centre line 71 of the elastic ring are not co-axial and the compressive

forces cannot be distributed equally over elastic ring 2. Therefore, the elastic ring 2 will distort or escape from the upper clamping plates 1 and the lower clamping plates 3 as shown in Fig. 14.

This invention is designed for use with expansion seals having two fitting holes, three fitting holes or four fitting holes as shown in Fig. 12 and Fig. 13. The method of operation of these additional seals is similar to this invention which has been disclosed with reference to a single hole seal as described above.

The elastic ring 2 can be cut to form a slant slit 23 so that the compressive force can be distributed over the contact face of the slant slit 23. The elastic ring 2 can be drawn into a rectangular shape from the slant slit 23, meanwhile the upper clamping plates 1 and the lower clamping plates are drawn so as to cover cable easily as shown in Fig. 3.

The expansion seal described can be used with cable pipe of various outside diameters and the elastic ring 2 can be fitted with various diameter pipe sleeves 6 in the inner wall of the elastic ring 2. The various diameter pipe sleeves 6 are made of elastic type material such as soft plastics, rubber etc. and can be cut to form slant slits 62 so as to cover the cable easily. The diameter pipe sleeves 6 each have a flange 64 so that when these pipe sleeves 6 are located in the elastic ring 2, the flanges 64 prevents these pipe sleeves from escaping out of the elastic ring 2. Therefore, the user can choose the most appropriate combination by adding or removing these pipe sleeves 6 to match the cable diameter. Accordingly, if the seal of this invention has two fitting holes, three fitting holes or four fitting holes, the slant slit 23 of

the elastic ring 2 and the slant slits 62 of the various diameter pipe sleeves 6 can be drawn outwardly to cover the cable easily, whereupon the elastic ring 2 and the various diameter pipe sleeves 6 are placed into the cable pipe and fastened by the bolts 4 so as to form a seal.

CLAIMS:

1. An expansion seal for cable pipe comprising a plurality of upper and lower clamping plates having frusto conical surfaces thereon, an elastic ring located between the upper and lower clamping plates and having a slit formed in the elastic ring at an angle relative the axis of the ring, a plurality of symmetrical through holes located parallel to the said axis, slant faces on the upper surface and the lower surface of the elastic ring having advanced angles which form slant faces at the inner circumference and the outer circumference of the elastic ring; and a plurality of connecting elements arranged to interconnect the elastic ring, the upper clamping plates and the lower clamping plates.

2. An expansion seal as claimed in claim 1, wherein the upper clamping plates and the lower clamping plates comprise first and second steps.

3. An expansion seal as claimed in claim 2, wherein the first step has a bottom surface arranged to contact the upper surface of the elastic ring, the first step also having a clamping portion which is connectable with the second step of another clamping plate by connecting elements.

4. An expansion seal as claimed in claim 2, wherein the first step and the second step define a gap therebetween the to allow the second step to be inserted into first step and to ensure the compressive force is

distributed over the elastic ring.

5. An expansion seal as claimed in claim 2 or claim 4, wherein the second steps have at least one hole which is symmetrical to at least one of the through holes of the elastic ring.

6. An expansion seal as claimed in claim 2, wherein the upper clamping plates having respectively curve faces at its outer circumference, the curve faces being formed from the bottom surfaces of the second steps of the upper clamping plates extending respectively to one end, from the ends extending upwardly to the bottom surfaces of the first steps of the upper clamping plates forming slant faces, at the inner circumferences of the upper clamping plates having slant faces which being symmetrical to the outer slant faces, the inner slant faces outer slant faces being matched with the upper surface of the elastic ring.

7. An expansion seal as claimed in claim 2, wherein the outer circumferences and the inner circumferences of the lower clamping plates have outer slant faces and inner slant faces which are symmetrical to the outer slant faces and inner slant faces, respectively, of the upper clamping plates and can be matched with the lower surfaces of the elastic ring.

8. An expansion seal as claimed in claim 1, wherein each pipe sleeve is made of elastic material such as soft plastics or rubber and is cut forming a slant slit, at the end of the pipe sleeve having a flange which extends outwardly at its end.

9. An expansion seal substantially as hereinbefore

described with reference to, or as illustrated in Figs. 1,2,3,5 and 6 or; Fig. 4 or; Fig. 7 or; Fig. 8 or; Fig. 9 or; Fig. 10 or; Fig. 11 or; Figs. 12A and 12B or; Figs. 13A and 13B or; Fig. 14 or; Fig. 15 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number: GB 9126223.8

Relevant Technical fields

(i) UK Cl (Edition L) H2C (CCH, CCM), H2E (EGAU2)

(ii) Int Cl (Edition 5) H02G (3/28), F16L (5/00, 5/02, 7/00)

Search Examiner: MR J L FREEMAN

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search: 22 JAN. 1993

Documents considered relevant following a search in respect of claims 1 TO 9

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2140114 A (WERNER HAUF) all figures	1 at least
X	EP 0355270 A (PLASTOFORM) Figures 6 to 8 [= US 4993724]	1 at least
X	EP 0307780 A (LE JOINT FRANCAIS) all figures	1 at least
X	US 4377291 A (F G ALBERTINI) Figure 1	1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

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